INFRA-RED FLAME DETECTION

FV282f+

TRIPLE IR FLAME DETECTOR FM APPROVED

USER MANUAL

FV282f+ USER MANUAL INDEX

SECTION A - INTRODUCTION

1. INTRODUCTION

The FV282f+ triple IR flame detectors is FM Approved flameproof (see Section 9).

The FV282f+ Advanced Flame Detector has approved Fault and Alarm Relay outputs. It also has a 4-20mA Interface. The detector offers high performance flame detection capability and excellent immunity to blackbody radiation.

2. FLAME DETECTION OPERATION

The FV282f+ detectors analyse radiant energy at three different wavelengths and, as such, offer the full benefits of Triple IR flame detectors. The detector uses a well proven, flame detection technique. This is based on monitoring for modulated infra-red radiation in the 4.3 µm waveband corresponding to CO_2 emission. It incorporates patented techniques for improved rejection of solar energy by use of two 4.3 µm filters and for Gaussian noise rejection by averaging the output signal of two separate sensor elements.

The time to alarm is field adjustable. Three different alarm delays of 3s, 6s and 12s are provided.

2.1 BLACKBODY REJECTION

The FV282f+ incorporates a novel optical filter(1) which enables a single electronic infra-red sensor to measure the radiated energy present in two separate wavebands placed on either side of the flame detection waveband, at 3.8 µm and 4.8 µm respectively (see Figure A-1). The signal obtained from this ‘guard’ channel is cross-correlated with the signal from the flame detection channel to provide an accurate prediction of the non-flame energy present in the flame detection waveband. This prediction is independent of the temperature of the radiation source, allowing the FV282f+ to provide blackbody rejection over a wide range of source temperatures.

(1) Patented, see Section C10.

Figure A-1 shows the amount of energy given by a ‘hot’ object (blackbody) as viewed in the electromagnetic spectrum. This curve has a peak which moves further to the left with higher temperature objects. The amount of energy seen between 3.8 µm and 4.8 µm can be approximated to a linear function. Thus a measurement of the energy at these two wavelengths provides information to calculate with sufficient accuracy the level of blackbody radiation at the intermediate flame detection frequency of 4.3 µm. The energy due to the emission from hot carbon dioxide given by a flame is superimposed on that from any blackbody in the detector field of view without adding any significant emissions at 3.8 µm or 4.8 µm, thus enabling proper segregation between non-flame signals and flame signals. Because a large fire will possibly produce a large amount of black smoke which will behave like a blackbody and may weaken the carbon dioxide peak, signals greater than a pre-determined upper limit will be classed as a fire.

The use of an optical processing technique, as opposed to the use of two separate electronic sensors for the guard channel, improves the overall reliability of the detector by reducing the number of components and eliminating the need for complex calibration procedures during manufacture.

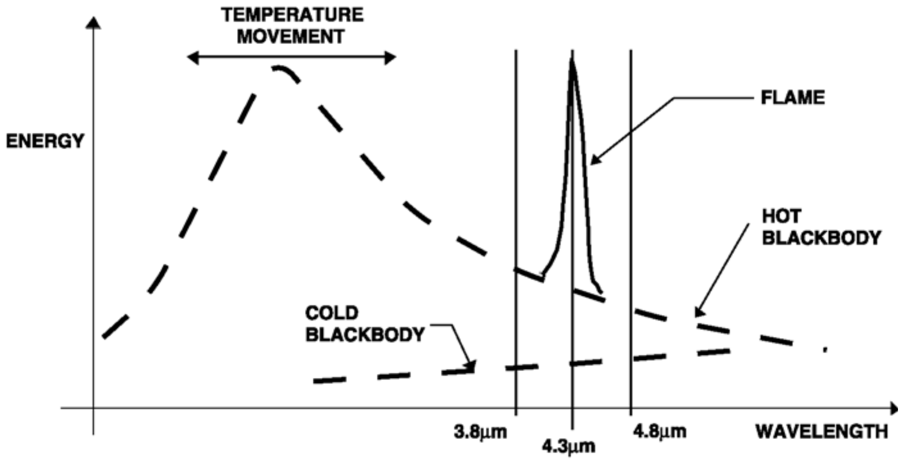


Fig. A-1 Radiation from Objects

2.2 DETECTION RANGE

The FV282f+ can detect on axis a fully developed 1ft^2 (0.09m^2) n-heptane pan fire at 164ft (50m) on the 50m setting and the same fire at 82ft (25m) on the 25m setting. A 40ft (12m) setting is also available.

2.3 DETECTION OF FLAME IN THE PRESENCE OF BLACKBODY RADIATION

The ability of the detector to determine accurately the amount of non-flame radiation received at any one time by the flame detection channel allows a variable alarm threshold to be determined (see Figure A-2). This threshold is positioned so as to minimise the possibility of a false alarm due to the presence of modulated blackbody sources of different temperature and intensity.

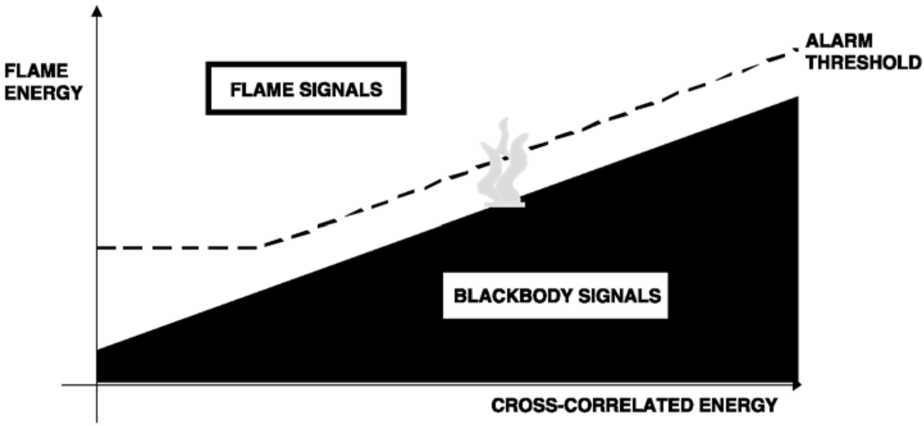


Fig. A-2 Signal Processing

2.4 DETECTOR CONDITION SIGNALLING

The FV282f+ incorporates two different colour light emitting diodes, red for Alarm and yellow for Fault. By using different flashing rates for the yellow (Fault) LED, separate indication of detector (electronic) fault and 'dirty' window (optical integrity monitoring) is provided.

3. GENERAL CONSTRUCTION

Figure A-3 shows a general view of a complete detector.

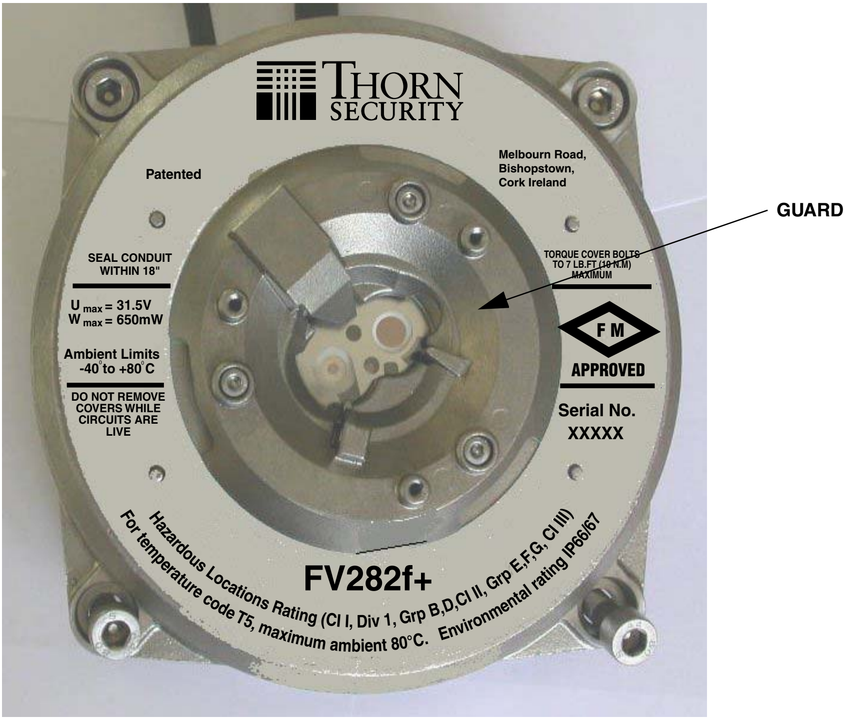


Fig. A-3 FV282f+ Detector - General View

The detector is of robust construction to allow its use in harsh environments.

The detector comprises a two-part stainless steel enclosure. The front section of the enclosure contains the encapsulated electro-optical assembly which is connected to the terminal board on the rear section by a small cableform. A sapphire window is fitted in the front of the housing. The window allows infra-red radiation to fall on the sensors, the LED alarm and fault indicators are visible through the window.

The front section of the enclosure is attached to the rear section by four captive screws. A seal provided between the front and rear sections ensures protection to NEMA 4 (IP66/IP67).

Two $^1/_2$″ - 14NPT cable entries are provided on the bottom. All electrical connections are made to three 4-way terminal blocks.

The detector may be fitted directly to a suitable surface or an optional adjustable mounting bracket may be used.

A stainless steel guard (Figure A-3) is fitted to the detectors to protect the integrity of the window.

SECTION B - PRODUCT APPLICATION

1. APPLICATION

1.1 GENERAL

The detectors are intended for the protection of high-risk areas in which accidental fires are likely to result in flaming combustion with the production of carbon dioxide. Typical materials in this type of risk are:

a) Flammable liquids, including petroleum products, alcohol, and glycol etc.
b) Flammable gases including methane.
c) Paper, wood and packing materials.
d) Coal.
e) Plastics.

These substances ignite readily and burn rapidly, producing flame, often accompanied by large volumes of dark smoke.

Note: The detectors are not designed to respond to flames emanating from fuels which do not contain carbon eg hydrogen, ammonia, metals, and should not be used for such risks without satisfactory fire testing.

The FV282f+, by virtue of its construction and rejection of spurious radiation, is suitable for use both indoors or outdoors in a wide range of applications.

Note: The detectors should be mounted only to rigid surfaces when the field of view of the detector is covering a large area of blackbody radiation, as oscillation of the detector could cause false alarms, eg, pole mounted detectors in a windy location.

1.2 FEATURES

- A self-test facility is incorporated to test a number of characteristics, including the cleanliness of the window. The self-test may be initiated remotely.
- Switch selectable range settings.
- Switch selectable time to alarm settings.
- Operational range up to 178 ft (54m), fuel dependant.
- Remote control of range.
- Completely solar blind.
- Very low quiescent power consumption.
- High sensitivity to hydrocarbon fire in oily environments.
- Rugged stainless steel 316 housing and mounting bracket.
- Flexible mounting and angular adjustment.
- Ease of installation.
- Connection for remote LED.
- Selectable latching/non-latching alarm output.
- Selectable latching/non-latching fault output.

2. BENEFITS OF THE FV282f+

Infra-red flame detectors offer certain benefits over detectors working in the visible or ultra-violet regions of the spectrum. For example they are:

- Highly sensitive to flame thus increasing probability of early detection of hydrocarbon fires.
- Not greatly affected by window contamination by dirt and oil deposits thus decreasing maintenance frequency leading to operating cost reduction.
- Able to see flames through smoke, and able to see flames through high densities of solvent vapours thus increasing the probability of early detection of hydrocarbon fires over other (ultra-violet) detectors in the same conditions.

The FV282f+ have all the above benefits and additionally are:

- Completely “solar-blind” in normal conditions thus eliminating false alarms due to direct or indirect sunlight.
- Insensitive to electric arcs thus eliminating false alarms from welding operations.
- Insensitive to artificial light sources. See Section C (6.4) for more details on false alarm performance.
- Sealed to NEMA 4 (IP66/IP67), when suitable cable glands and sealant are used, ensuring long term reliability in harsh environments.

SECTION C - SYSTEM DESIGN INFORMATION

1. INTRODUCTION

The electrical, mechanical, environmental characteristics and the performance of the FV282f+ flame detector, must be taken into account when designing a system which uses these detectors. This information is given below, together with guidance on detector siting.

2. ELECTRICAL CHARACTERISTICS

The FV282f+ provides a relay interface for alarm and fault conditions.

2.1 TECHNICAL DATA

Supply Voltage:	16.8V to 31.5V. (Voltage at the detector).
Reset Time/Voltage:	Supply must be reduced to less than 2V for greater than 0.5 seconds.
Stabilisation Time after reset /power up:	30 seconds.

Detector current consumption without 4 to 20 mA current sink resistor connected. Detector supply 28V.

Quiescent Current:	11mA typical (Fault relay energized).
Alarm Current:	30mA typical (Fault and Alarm relay energized).
Fault Current:	0.4 to 1.1mA pulsing. (neither Fault or Alarm relay energized).
Fault relay:	Normally closed, opens under fault conditions.
Alarm relay:	Normally open, closes under alarm conditions.

Detector current consumption with 4 to 20 mA current sink resistor connected. Detector supply 28V

Quiescent Current:	15mA typical (Fault relay energized).
Alarm Current:	50mA. typical (Fault and Alarm relay energized).
Fault Current:	2.3 to 3.5mA pulsing.

There are two 4-20mA output modes (see Table 1):

- Discrete - where the output switches from normal to alarm.
- Continuous - where the output changes with the input signal and the alarm and pre-alrm may be set in the PLC.

CONDITION	DISCRETE SIGNALLING (mA)	CONTINUOUS SIGNALLING (mA)
Non Window Fault	1.5	0
Window Fault	1.5	2
Normal	4.5	4
Alarm	17	5.7 to 17

Table 1:

Note:

1) *The relay contacts are rated 2A at 30V d.c.*
2) *No remote LED option is available.*

3. MECHANICAL CHARACTERISTICS

3.1 TECHNICAL DATA

Dimensions (see Figure B-1)

Weight:	8.4 lb (3.8kg)
Mounting Bracket Weight:	2.4 lb (1.1kg)

Materials

Enclosure:	Stainless steel 316L.
Window:	Sapphire.
Mounting Bracket:	Stainless steel 316 S16.
Screws etc. exposed to the elements:	Bright stainless steel 316

Electronic Module Encapsulated

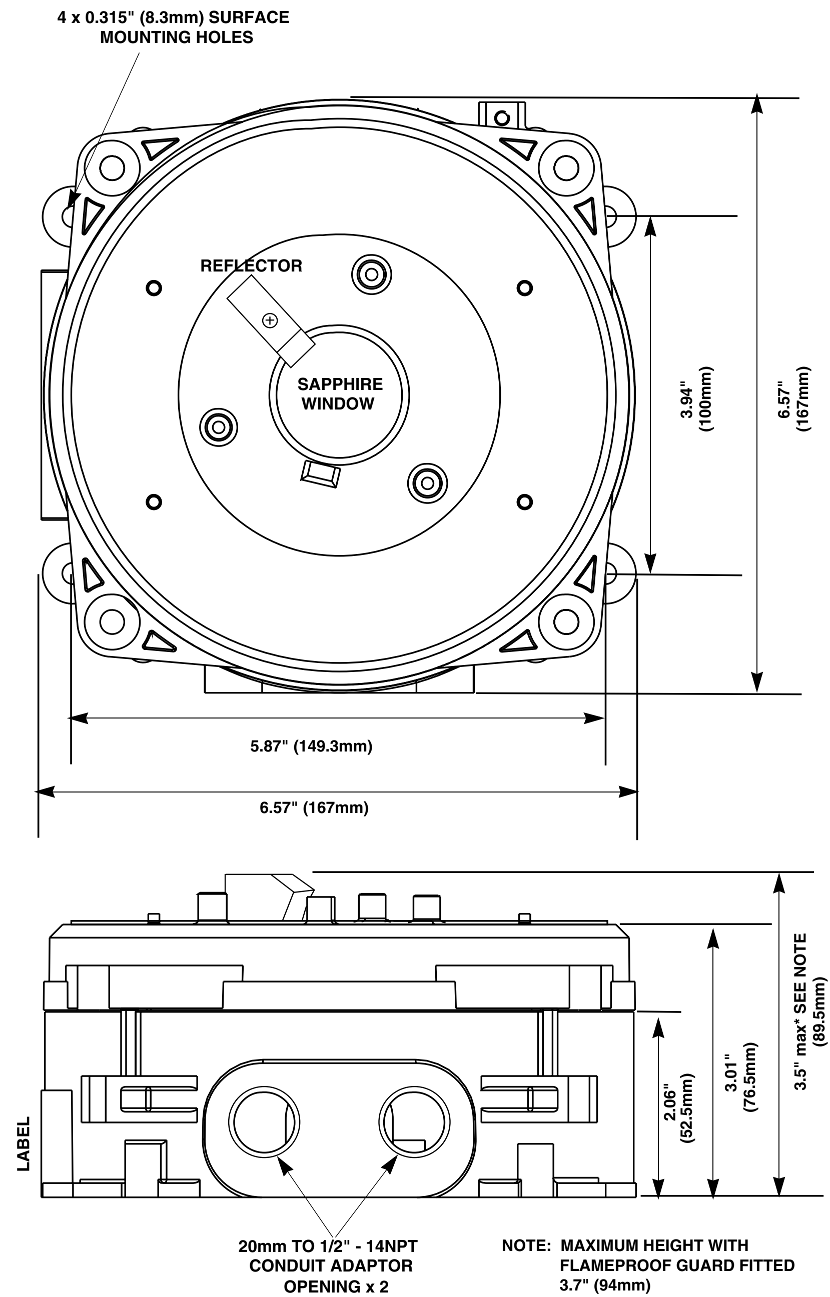


Fig. C-1 FV282f+ - Overall Dimensions

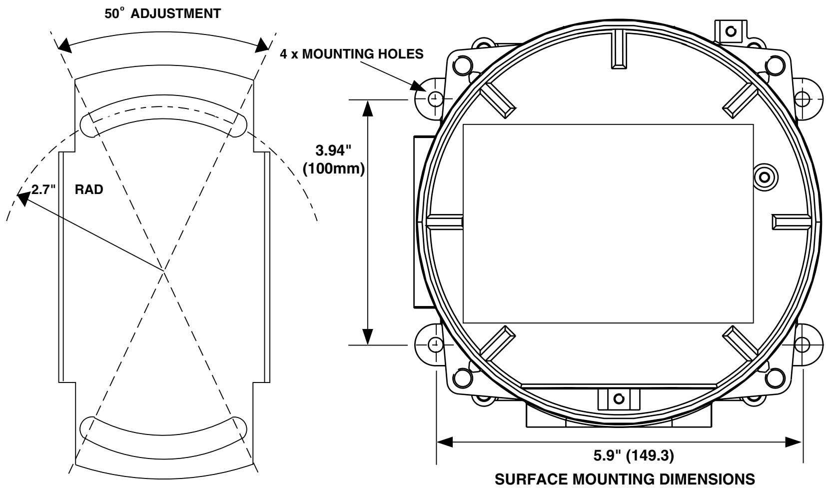


Fig. C-2 Adjustable Mounting Bracket and Surface Mounting Dimensions

4. ENVIRONMENTAL

4.1 GENERAL

The design and construction of the FV282f+ detectors is such that it may be used over a wide range of environmental conditions. Relevant limits are given in Para 4.2.

4.2 TECHNICAL DATA

4.2.1 TEMPERATURE, HUMIDITY, PROTECTION AND PRESSURE

Operating temperature range:	-40° to +80°C / -40°F to +176°F (110°C / 230°F for short durations)
Storage temperature range:	-40°C to +80°C / -40°F to +176°F
Relative humidity:	up to 95% RH (non-condensing)
Enclosure protection:	NEMA 4 (IP66/IP67)*
Normal operating atmospheric pressure:	910mbar to 1055mbar
Heat radiation from sun or flame:	0 to 1000Wm^2
Hazardous location ratings (Explosionproof):	Class I, Division 1, Groups B, C and D
Hazardous location ratings (Dust ignitionproof):	Class II, Groups E, F, G and Class III

* Cable gland entries must be suitably sealed to achieve the required NEMA rating.

4.2.2 DETECTOR PERFORMANCE

The FV282f+ detectors are designed and tested to Factory Mutual standards 3260 and 3615.

4.2.3 WEATHER SHIELD

A Stainless steel weather/sun shield is available to reduce the heating effect of the sun in tropical conditions, where the detector has to be mounted in direct equatorial sun. The shield also provides protection from rain and snow falling on the window. The sun shield fits round the bracket and is bolted on to the rear of the detector.

5. ORDERING INFORMATION

FV282f+ Relay Interface:	516.040.014
S100/S200 Mounting Bracket:	517.001.184
S200+ Weather/Sun Shield:	517.001.263
S200+ Spares Kit & Sealant:	517.001.266
T210+ Infra-red Test Source:	592.001.016
T210+ S200 Adaptor:	592.001.014
T210+ Nicad battery and charger:	592.001.010
Solo 100 telescopic extension pole set:	517.001.230
Solo 101 extension pole:	517.001.226
Solo 704 adaptor tube B:	517.001.224
Solo 610 Carryall bag:	517.001.264

For information on the T210+, see Section E, Para 1.3.

6. OPERATION

6.1 ALARM INDICATION

A red LED is visible through the front window, continuous illumination indicates an alarm.

6.2 ALARM SIGNALLING

The detectors signal an alarm condition as follows:

- Alarm relay will close.

The FV282f+ may be set as alarm latching or non-latching. In the non-latching mode if the alarm source is removed for greater than 5 seconds then the detector will stop indicating an alarm. In the latching mode the controller must be reset to remove the alarm condition.

6.3 FAULT INDICATION

The FV282f+ yellow LED will flash indicating a fault. Different flashing rates are used to indicate different faults, as follows:

- Window obscuration: 0.5Hz
- Detector fault: 2.0Hz

6.4 FAULT SIGNALLING

The detectors signal a fault condition as follows:

- Fault relay will open.

The FV282f+ detectors may be selected as fault latching or non-latching. In the non-latching mode, the fault condition will be cancelled up to 80 seconds after the fault has been removed.

6.5 SENSITIVITY (RANGE) SELECTION

The range is switch selectable on a 6-way DIL switch (S1) on the backbox terminal PCB. The following nominal ranges are available:

- Extended range. 164 ft (50 meters)
- Normal range. 82 ft (25 meters)

There is provision for halving the range value selected by the switches. If the terminal connector 'Range' is connected to 0V then the detection range is reduced to half that of the switch setting. This may be done by taking cables to a remote contact the other side of which is connected to the same 0V as the reference for 'Line In' supply.

6.6 DELAY TO ALARM

The minimum delay to alarm is 3 seconds from a fire being present in the field of view that is large enough to be detected. This delay is also switch selectable using 6-way DIL switch (S1), the following additional nominal values are available:

- 6 seconds.
- 12 seconds.

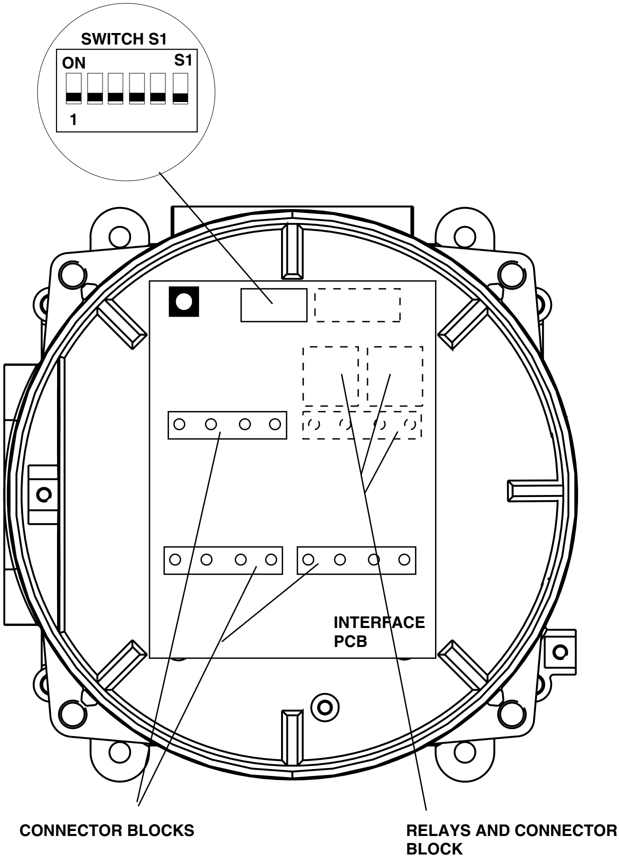


Fig. C-3 Switch Location

6.7 SELF-TEST

The detector normally carries out a complete self-test every 20 minutes. The self-test exercises the pyro-electric sensors and the electronics, and monitors the window for cleanliness. If the window cleanliness test fails on 20 successive occasions (6 hours 40 minutes), a fault condition is generated and the fault LED, where fitted, flashes at the rate of 0.5Hz. In this condition, the window self-test only is automatically repeated every minute until the window clears and window self-test passes. If the window test continuously fails then the complete self-test will still be repeated every 20 minutes. Other self-test failures will be indicated on the first test after they have occurred.

For the complete 'self-tests' to be run automatically, the 'self-test' connection on the terminal board must be left open circuit when the unit is powered up. In this mode, additional self-tests may be initiated remotely by connecting 0V to the 'self-test' terminal, refer to the wiring diagrams in Section D.

The detector may be powered up in such a condition that the window ‘self-test’ can only be initiated remotely on demand (the automatic window ‘self-test’ is disabled). In order for this to be achieved the detector must be powered up with the ‘self-test’ terminal connected to 0V (terminals 3 or 5). To initiate the test for the first time after power up, the connection to the ‘self-test’ terminal must be opened for at least 5 seconds and then closed again. This ‘self-test’ function (which takes 10 seconds) will commence within 2 seconds of the closing and the result of the test indicated for as long as the connection remains closed.

If the test passes, an alarm condition will be indicated and if it fails a fault condition will be indicated. To remove the test indication, the connection to the ‘self-test’ terminal must be opened. A self-test fail indication due to a window fault will remain until a window ‘self-test’ is successful and will then unlatch after a 1 minute delay. The ‘self-test’ should not be repeated more frequently than every 20 seconds (to allow the ‘self-test’ circuitry to recharge) as erroneous results may occur.

Note that if a unit is poorly sited such that sunlight can reach the window test detector element, the receive amplifier may saturate. In this event, that particular test is aborted and if this situation persists for 6 hours 40 minutes, the unit will register a fault condition.

CAUTION:

A REMOTELY INITIATED TEST WILL PRODUCE AN ALARM SIGNAL FROM THE DETECTOR IF THE TEST SHOWS THAT THE WINDOW IS CLEAN.

TAKE THE NECESSARY STEPS TO INHIBIT A FULL ALARM CONDITION AT THE CONTROL PANEL BEFORE PROCEEDING.

IF THE SELF-TEST CONNECTION IS NOT OPENED AFTER A SELF-TEST THE DETECTOR WILL REMAIN DISABLED.

The window ‘self-test’ may be disabled by permanently connecting the ‘self-test’ terminal to 0V (pins 3 or 5) before power up. This may be desirable in those conditions in which contaminants may make the window appear dirty but which may not affect the ability of the detector to otherwise function normally.

The detector may be reset by reducing the voltage to less than 2 volts for greater than 0.5 seconds.

A remote LED may be used with the detector.

7. PERFORMANCE CHARACTERISTICS

7.1 GENERAL

A large number of fire tests have been carried during the development phase of the FV282f+ detectors to determine their response limits. The results of these tests are summarised below. In order to appreciate their significance, an understanding of the mode of the operation of the detector is necessary, and a brief explanation follows:

7.2 MODE OF OPERATION - BEHAVIOUR IN FIRE TESTS

Flaming fires involving carbonaceous materials produce large quantities of carbon dioxide. This part of the combustion process gives rise to a very high level of infra-red radiation in a narrow wavelength region centred upon 4.3µm.

The radiation from a fire flickers in a characteristic way and the detector uses this flicker signal in conjunction with the black body rejection technique described in Section A to discriminate between flame and non-flame signals.

The level of the signal depends upon the size of the flame and its distance from the detector. For liquid fuels the signal level increases as the surface area of the burning liquid increases. For any type of fire the signal level generally varies inversely with the square of the distance.

For convenience, fire tests are normally carried out using liquid fuels burning in pans of known area in still air.

Note: The results of fire tests can be significantly affected by weather conditions prevailing at the time, eg - wind.

The sensitivity of a detector can then be conveniently expressed as the distance at which a particular fire size can be detected. While the FV282f+ will reject modulated signals from blackbody sources, the presence of such sources of high intensity may affect the sensitivity of the detectors.

It is important to think in terms of distance rather than time because of the different burning characteristics of different fuels. Figure C-4 shows the response to two different fuels which ultimately produce the same signal level.

The signal level given by gasoline quickly reaches its maximum, and produces an alarm within about six seconds of ignition. Diesel, on the other hand, being less volatile, takes about a minute to reach equilibrium and an alarm is given in about 60 seconds from ignition.

Note: If a fire test is carried out using non-miscible fuels then it is strongly recommended that water be placed in the bottom of the pan to keep it cool and prevent it deforming. A sufficient amount of fuel must be placed in the pan to ensure combustion occurs over all of its area throughout the intended duration of the test.

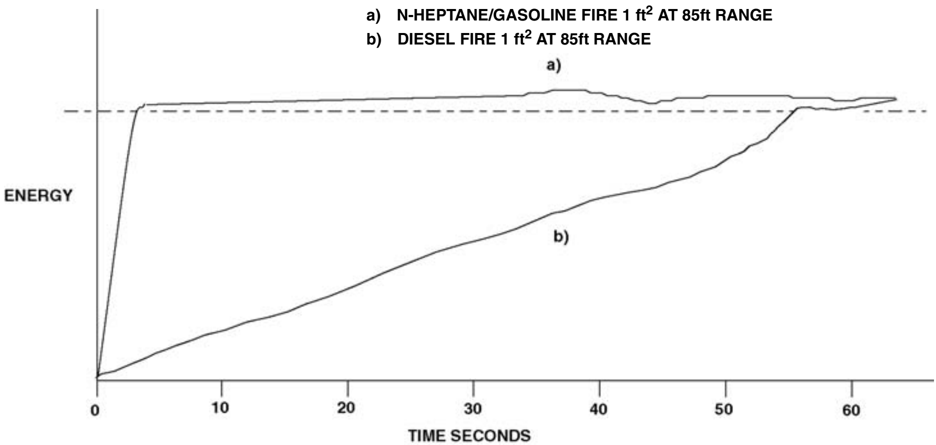


Fig. C-4 Characteristics of Fires

The time taken by the fire to reach equilibrium depends of course on the initial temperature of the fuel. If kerosene were to be pre-heated to a temperature above its flash point then its behaviour would be equivalent to that of gasoline at 25°C / 77°F.

The test data presented below refers to fires which have reached their equilibrium condition.

7.3 FIRE TEST DATA

7.3.1 N-HEPTANE

The most reliable fuel for consistent fire tests is n-heptane since it quickly reaches its equilibrium burning rate. FM detected 1ft^2 (0.9m^2) n-heptane pan fire on axis at 28.5m on 25m setting and 54.4m on 50m setting.

7.3.2 OTHER LIQUID HYDROCARBONS

Typical ranges achieved with other fuels burning on 1ft^2 (0.09m^2) pans, relative to that for n-heptane, are as follows:

	50m Range Setting	25m Range Setting
Alcohol [Ethanol, Methanol]	66%	83%
Gasoline	63%	80%
Paraffin, Kerosene, JP4	54%	44%
Diesel fuel	50%	45%

The detection range is also a function of pan area. Manufacturers field trials indicate that the detection range increases by approximately 20% when the pan area is doubled.

7.3.3 DIRECTIONAL SENSITIVITY

WARNING:
WHEN MOUNTING THE FV282f+ DETECTORS, ENSURE THAT THE PART OF THE FLAMEPROOF GUARD INDICATED IN FIG. C-5 IS NOT DIRECTED AT THE RISK AREA BEING PROTECTED.

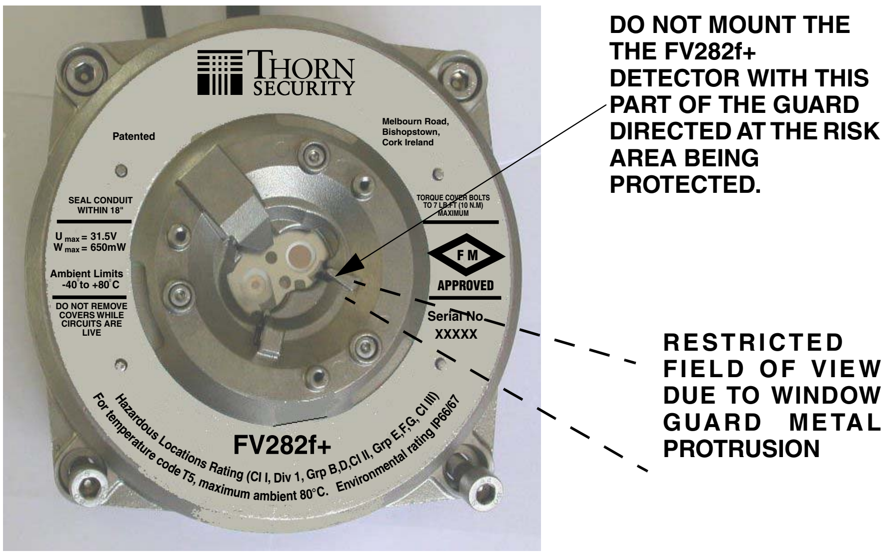


Fig. C-5

The sensitivity of the FV282f+ is at a maximum on the detector axis. The variation of range with angle of incidence is shown in Figures. C-6 and C-7 for open air tests using 1 ft^2 (0.09m^2) kerosene pan fires with the detector operating at normal range.

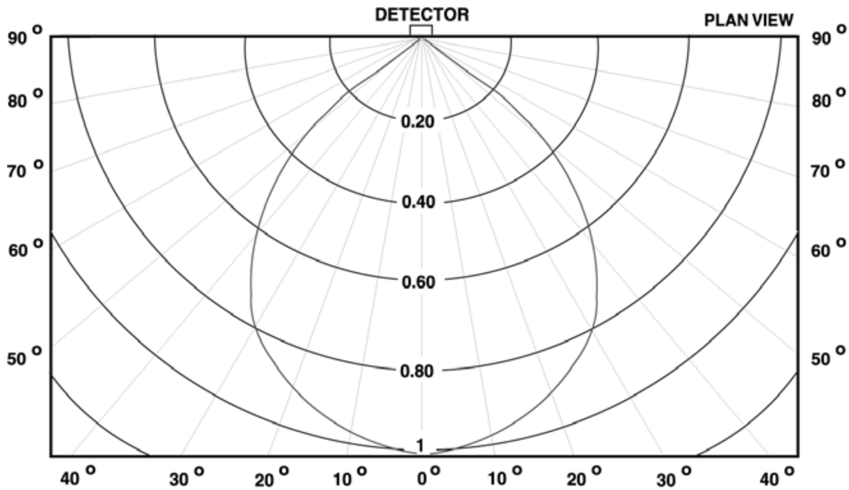


Fig. C-6 Pan Fires - Relative Range vs Angle of Incidence. - Horizontal

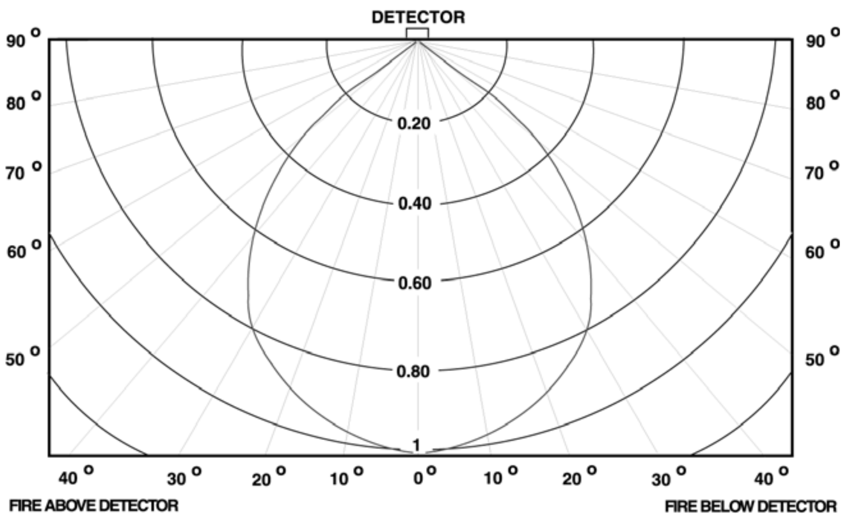


Fig. C-7 Pan Fires - Relative Range vs Angle of Incidence. - Vertical

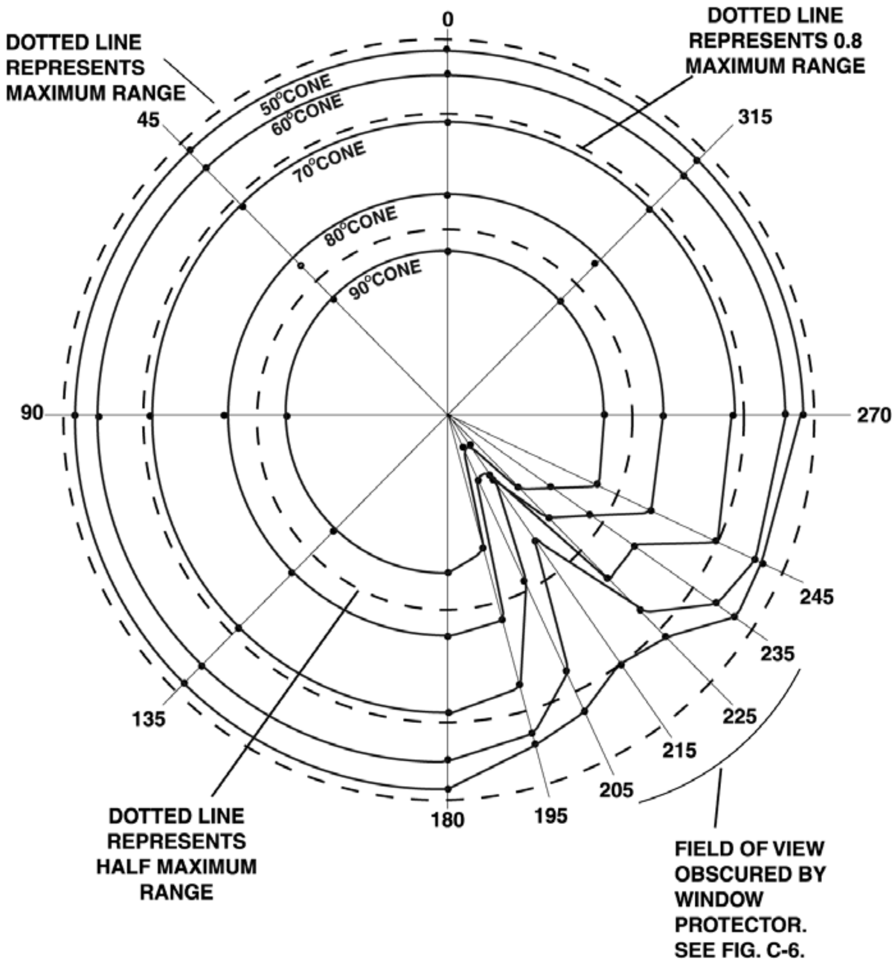


Fig. C-8 FV282f+ Detection Range for Viewing cones of 50, 60, 70, 80 and 90°.

7.4 HOT BODY DISCRIMINATION - FIELD OF VIEW

The FV282f+ flame detector discriminates against false alarms from hot radiating objects in the field of view of the detector. This is done firstly by looking for modulation in the flame flicker frequency band (1 to 20Hz) and secondly by comparing the signal in the guard channel. For the FV282f+ detector there are two areas in the field of view where the guard channel is partly obscured. In these areas the discrimination against modulated black bodies is compromised and a modulated black body could possibly produce an alarm.

The areas where this may happen are shown shaded in the field of view diagram in Fig. C-9. Detectors should be mounted so that potential hot bodies are not located in the shaded areas. This can normally be achieved by rotating the detector.

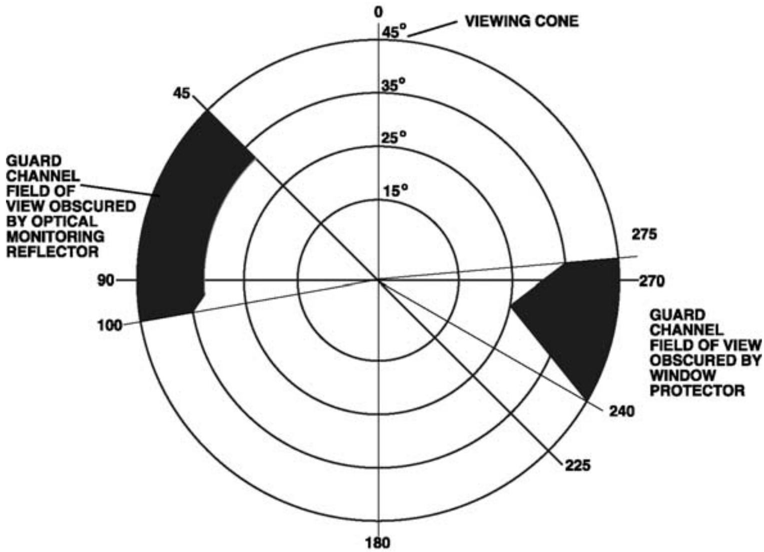


Fig. C-9 Areas Where FV282f+ May Not Discriminate Between Fire and a Modulated Hot Body

7.5 FALSE ALARM DATA

The FV282f+ has been subjected to the following stimuli which might be considered potential sources of false alarms. Unless otherwise specified, tests were performed at a minimum distance between source and detector of 1 ft (0.3m). Detectors were set to maximum sensitivity 164 ft (50m range). Steady state sources were chopped at frequencies in the range 1 - 10Hz.

	RADIATION SOURCE	IMMUNITY DISTANCE (ft)
1	Sunlight	No response
2	Sunlight with rain	No response
3	100W tungsten filament lamp	No response
4	Fluorescent lamp (bank of 4 x 32 W circular lamps)	No response
5	125W mercury vapour lamp	No response
6	1 kW radiant electric fire element	> 1.5
7	2 kW fan heater	No response
8	3 kW IR heater	> 3
9	Halogen torch	No response
10	Car headlights (60W halogen)	No response
11	Lighted cigarette	No response
12	Grinding metal	No response
13	Electric arc welding ($^1/_8$" rod 120A)	>16
14	Photographic quartz lamp (1000W)	> 1
15	Photographic electronic flash unit*	No response

*Minolta Maxim/ Program Flash 5400HS - operated in both single and multi-flash modes.

8. DESIGN OF SYSTEM

8.1 GENERAL

Using the information given in Sections 5 and 6 it is possible to design a flame detection system having a predictable performance. Guidelines on the application of the above data and on siting of detectors is given in the following paragraphs.

CAUTION:

THE GUIDELINES GIVEN CANNOT CATER FOR ALL EVENTUALITIES THAT MAY BE ENCOUNTERED ON A SITE.

8.2 FIRE TEST DATA

It has been explained in Section 6 that the sensitivity of the detector is most easily specified in terms of its response to well-defined test fires. Tests are conveniently carried out using a 1 ft^2 ($0.09m^2$) pan. Sensitivity to other pan areas is estimated from field trial results.

8.3 DETERMINING NUMBER OF DETECTORS

It will be clear that the number of detectors required for a particular risk will depend on the area involved and the fire size at which detection is required. Large areas or small fires require large numbers of detectors.

There are as yet no agreed “rules” for the application of flame detectors and the overall system sensitivity must therefore be agreed between the installer and the end user. Once this agreement has been reached the system designer can determine the area covered by each detector using a scaled plot based on Figures. C-6 to C-7 and the fire test data. This plot is best drawn to the same scale as the site plan so that direct superposition can be used to determine detector coverage.

In carrying out the design, certain factors should be kept in mind:

a) For area rather than spot protection, the best coverage will normally be obtained by mounting the detectors on the perimeter of the area and pointing into the area.

b) As the FV282f+ is a line of sight detector, any object within the detector’s field of view will cause a “shadow” in the protected area. Even small objects close to the detector can cause large shadows.

c) The detector should not be mounted in such a position that water will collect on the window.

d) The detectors are passive devices and will not react with one another. They may therefore be positioned with their fields of view overlapping.

9. APPROVALS AND COMPLIANCE WITH STANDARDS

The FV282f+ detector (Fault and Alarm relay outputs) has been Approved by Factory Mutual. The detector is designed to comply with FM3615 (Explosionproof Electrical Equipment) in systems that comply with FM3260 (Flame Radiation Detectors for Automatic Fire Alarm Signalling). They are classified as explosionproof for Class I, Division 1, Groups B, C and D; and dust-ignitionproof for Class II, Groups E, F and G, Class III; and for indoor and outdoor application (IP66/67).

9.1 PATENTS

The FV282f+ design and manufacture is covered by the following patents:

UK patents	GB 2 281 615, GB 2 335 489
European patent	0 064 811
US patent	US 6,255,651

1. GENERAL

The FV282f+ detector may be surface mounted, or may use the S100/200 adjustable mounting bracket for fixing to a convenient rigid surface. All electrical connections are made via terminal blocks inside the detector rear housing. Two $^1/_2$″ - 14NPT cable entries are provided. Guidance on mounting and wiring the detectors is given below.

2. MOUNTING A DETECTOR

The location of each detector should have been determined at the system design stage according to the principles detailed in Section B and marked on the site plan.

The actual mounting position must, however, be decided during installation, and in choosing the position the following principles together with the original system requirements should be followed.

2.1 CHOICE OF MOUNTING POSITION

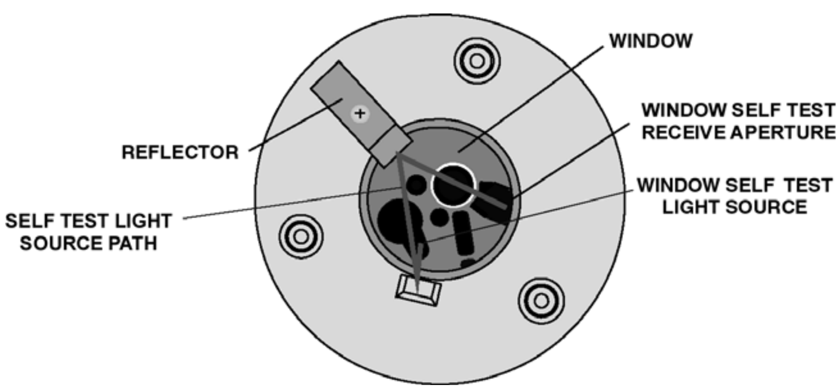
The following points must be observed when choosing the mounting position.

a) The detector must be positioned such that a clear line of sight is provided to all parts of the risk area. Roof trusses, pipework, supporting columns etc. in front of the detector can cause significant shadowing and should be avoided.

b) If supervision of an area immediately below the detector is required it is essential that the angle between the detector and the horizontal is not less than 50^{o}.

c) The detector should not be sited in a position where it will be continuously subjected to water drenching.

d) In outdoor installations in areas of high solar radiation, some form of sunshade is recommended to prevent excess heating of the detector.



e) Precautions should also be taken to ensure the angle of incidence of sunlight, either direct or reflected, is not such that it can penetrate the receiving aperture of the window test optical path.

f) The detector should not be sited in a position in which it will be subject to severe icing.

g) The detector must be mounted on a stable structure which is readily and safely accessible for maintenance staff.

h) Wherever possible, the detector should be mounted such that the face is tilted downwards at a small angle to prevent water collection and lessen the settlement of particle deposits on the window.

The detector mounting bracket is to be secured with two 0.315 inch bolts at the mounting centres shown in Fig. D-1. A drilling template is provided to allow optimum selection of the mounting centres of the 0.099 inch (2.5mm) diameter, 0.118 inch (3mm) deep pivot hole. The detector is to be secured to the bracket using the four M8 screws supplied with the detector.

Alternatively, the detector may be secured directly to the fixing surface with four 0.315 inch bolts, studs or screws at the fixing centres shown in Figure D-1. The surface chosen for the mounting should be flat over the area of the bracket to ensure a stable fixing.

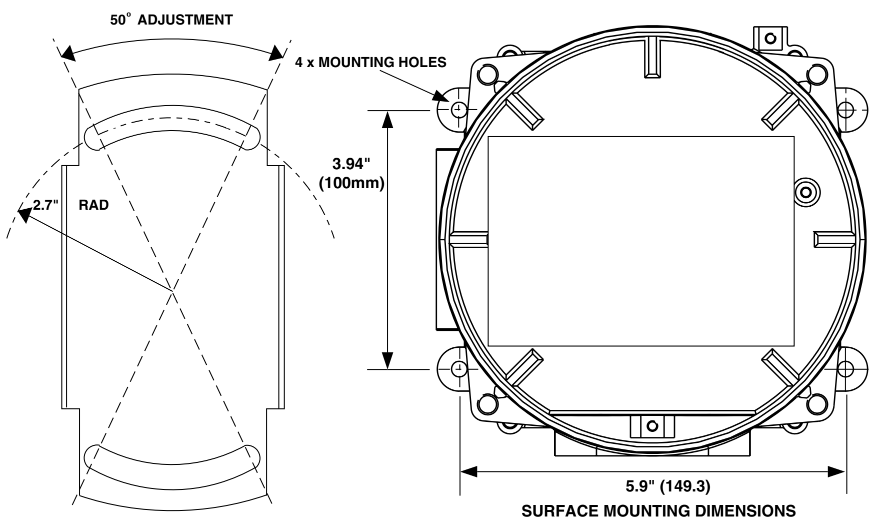


Fig. D-1 Adjustable Mounting Bracket and Surface Mounting Dimensions

The FV282f+ may be operated in any position but the mounting point must obviously be chosen to allow sufficient clearance for adjustment of the angle and must also allow space for the cable assembly. A clearance of 8″ (200mm), in all directions, from the fixing point will normally be sufficient to allow the full range of adjustment. (Figure D-2 refers).

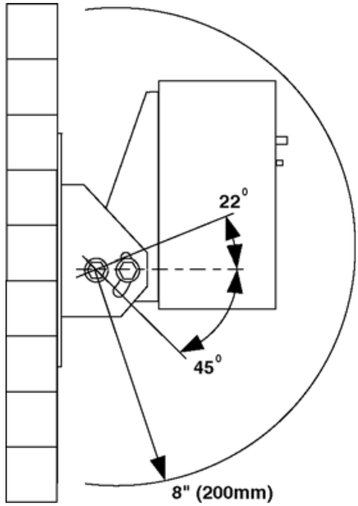


Fig. D-2 Clearance Required for Full Adjustment

3. DETECTOR WIRING

The wiring between the detectors and control equipment must provide the required degree of mechanical protection but allow the detector alignment to be adjusted to suit the area to be protected.

In order to minimize the risk of radio frequency interference it is recommended that some form of shielded wiring be used. The shield may take the form of steel conduit or metal sheathing of the cable and must be suitably grounded. Cabling must be terminated through 360^0 at the detector conduit entry and the detector housing must be solidly bonded to a good local ground.

The detector is supplied with two 20mm to $^1/_2$" - NPT adaptors. The two 20mm conduit entries when fitted with the $^1/_2$" - 14 NPT provided permit convenient connection of the incoming and outgoing lines with continuity of cable shields provided by internal connectors. The NPT adaptors must be used with either ‘o’ rings or sealant to comply with the IP rating.

It is recommended that, for optimum rejection of radio frequency interferences, ferrite beads are used to protect incoming and outgoing cables. See section 3.2 Fig. D-5 for fitting instructions.

On completion of installation, to ensure no moisture ingress to the detector during the time between installation and commissioning, fit the weatherproof cover Fig. D-3. Ensure that the ‘O’ ring supplied is fitted to the cover. Securely tighten the four socket cap cover retaining screws.

Figs. D-4 and D5 show the wiring diagrams.

Fig. D-3 Protective Cover

3.1 CABLE ENTRY SEALING

CAUTION:
CABLE GLANDS AND STOPPING PLUGS MUST BE SUITABLY SEALED TO PREVENT THE INGRESS OF MOISTURE.

Only cable glands incorporating an inner cable seal should be used. In exposed outdoor areas it is recommended that a shroud be fitted over the cable glands.

Cable glands should also be sealed to the detector housing by fitting a nylon washer between their flange and the housing. The stopping plugs with a mushroom head and integral ‘O’ ring (supplied) must be used to plug unused conduit entries. The glands/stopping plugs should be hand-tightened with the addition of, at least, a further $^{1}/_{4}$ turn applied by spanner or other suitable tool.

Alternatively, the thread of cable glands/stopping plugs used in Safe Area applications may be sealed using PTFE tape or other jointing putty or mastic. Flameproof glands/stopping plugs may be sealed using any non-setting grease or putty as described in IEC 79/14.

In applications where the ambient temperature is expected to be 104^{o}F (40^{o}C) or higher, cable glands with a silicon inner seal must be used and, when fitted, the shroud must be made of CR rubber.

CAUTION:
TO COMPLY WITH FM FLAMEPROOF REQUIREMENTS, ALL ADAPTORS, GLANDS AND STOPPING PLUGS MUST HAVE A MINIMUM OF 5 THREADS ENGAGED.

THE CONDUIT MUST BE SEALED WITHIN 18”

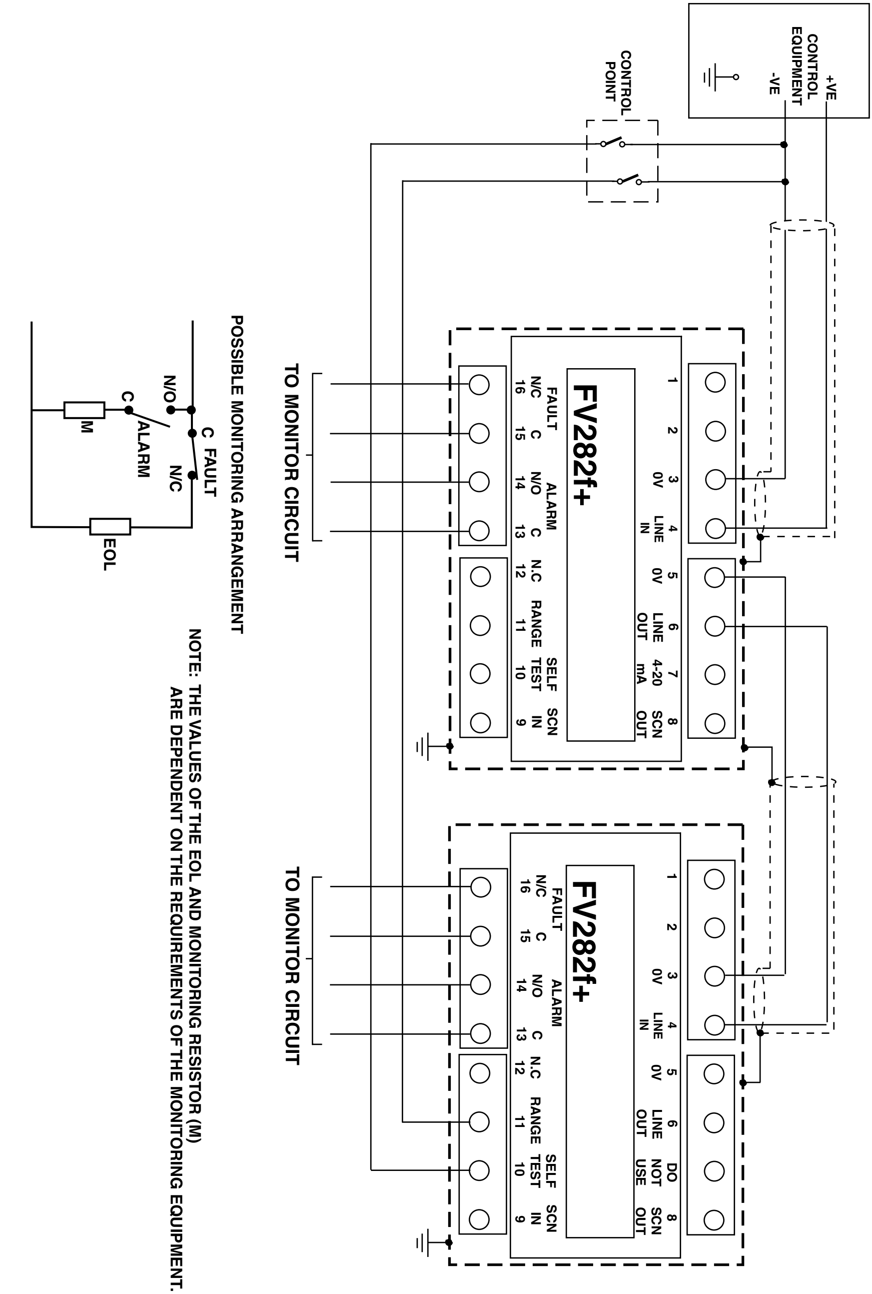


Fig. D-4 FV282f+ Relay Interface Wiring Diagram

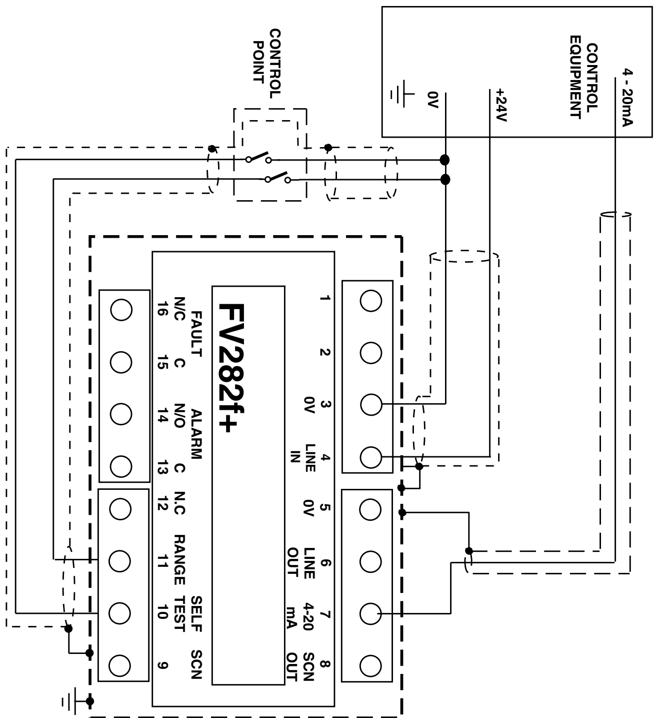


Fig. D-5   FV282f+ 4-20mA Interface Wiring Diagram

The 4-20mA Interface is a Current Sink

3.2 FITTING FERRITE BEADS

Fit the ferrite beads to conductors as shown in Fig. D-6.   For optimum RF suppression, each pair of cables must be looped once around the ferrite bead.

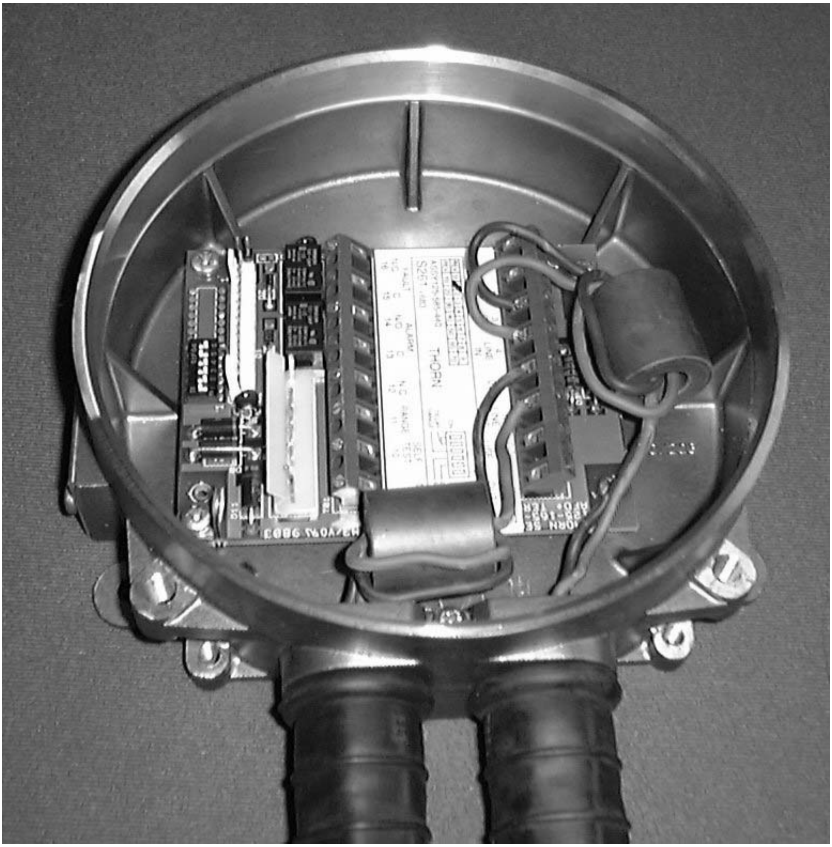


Fig. D-6   Fitting of Ferrite Beads

SECTION E - COMMISSIONING

1. CONNECTING AND COMMISSIONING THE DETECTORS

When the system wiring has been successfully tested and the control equipment commissioned, the detector electronic assemblies may be fitted. Set the Delay and (Table 2) Range/Latching, switches as required. Record the switch settings for future checking during service and maintenance inspections. The Window self-test may be disabled by linking the self-test terminal to 0V before applying power to the unit (ie terminal 10 linked to either terminals 3 or 5). Self-test may be demanded by taking the input high (disconnected) and then low again. Automatic operation will not restart unless the self-test input is disconnected before power-up.

CAUTION:

DO NOT MOVE THE ALARM OR FAULT LATCHING SWITCHES
AFTER THE DETECTOR HAS BEEN POWERED UP.

1.1 SWITCH SETTINGS

The following tables give the switch settings for switch S1, see Figure E-1 for switch location.

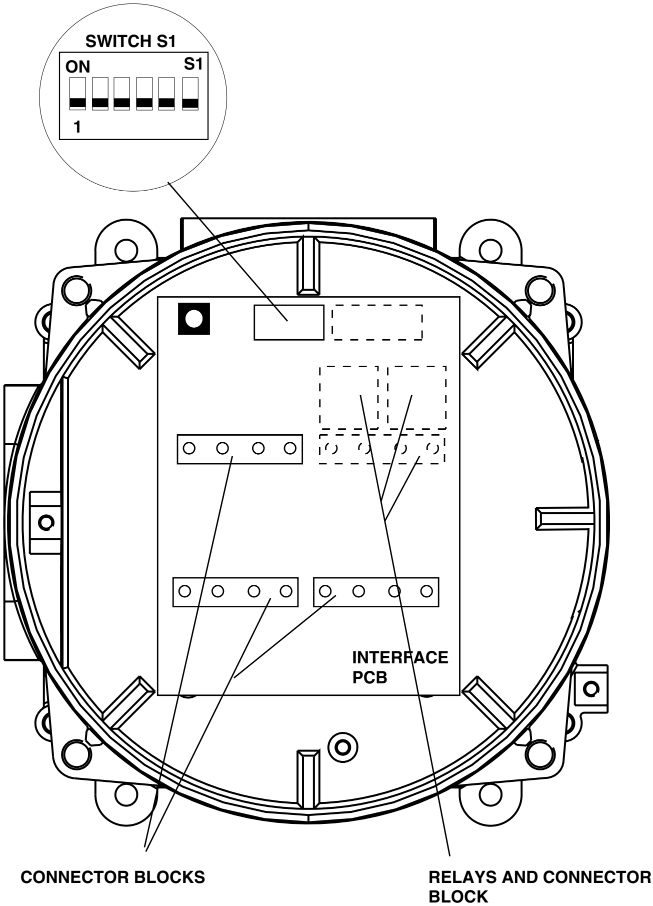


Fig. E-1 Switch Location

SW1-3	SW1-4	DELAY TO ALARM FUNCTION
OFF	OFF	3 POSITIVE SAMPLES FROM 5
ON	ON	3 POSITIVE SAMPLES FROM 5
OFF	ON	6 POSITIVE SAMPLES FROM 8
ON	OFF	12 POSITIVE SAMPLES FROM 14

Table 2: Delay Settings (All Types - one sample per second)

SW1-1	OFF	EXTENDED RANGE (50m)*
	ON	NORMAL RANGE (25m)*
SW1-2#	OFF	FAULT UNLATCHING
	ON	FAULT LATCHING
SW1-5#	OFF	ALARM LATCHING
	ON	ALARM UNLATCHING
SW1-6‡ 4-20mA only	OFF	DISCRETE SIGNALLING CURRENTS
	ON	CONTINUOUS SIGNALLING CURRENTS

Table 3: Range and Latching Settings

* The Range Settings are halved if the Range Terminal (No 11) is connected to 0 volts.

If switches SW1-2 and SW1-5 are changed from OFF to ON whilst the unit is powered, the change will not be effective until the unit is powered down and re-started.

‡ In the Variable Signalling Current mode (SW1-6 ON), the alarm output will always be UNLATCHING, ie, the setting of SW1-5 has no effect. In this mode, the final alarm decision and latching should be made at the controller, eg, PLC.

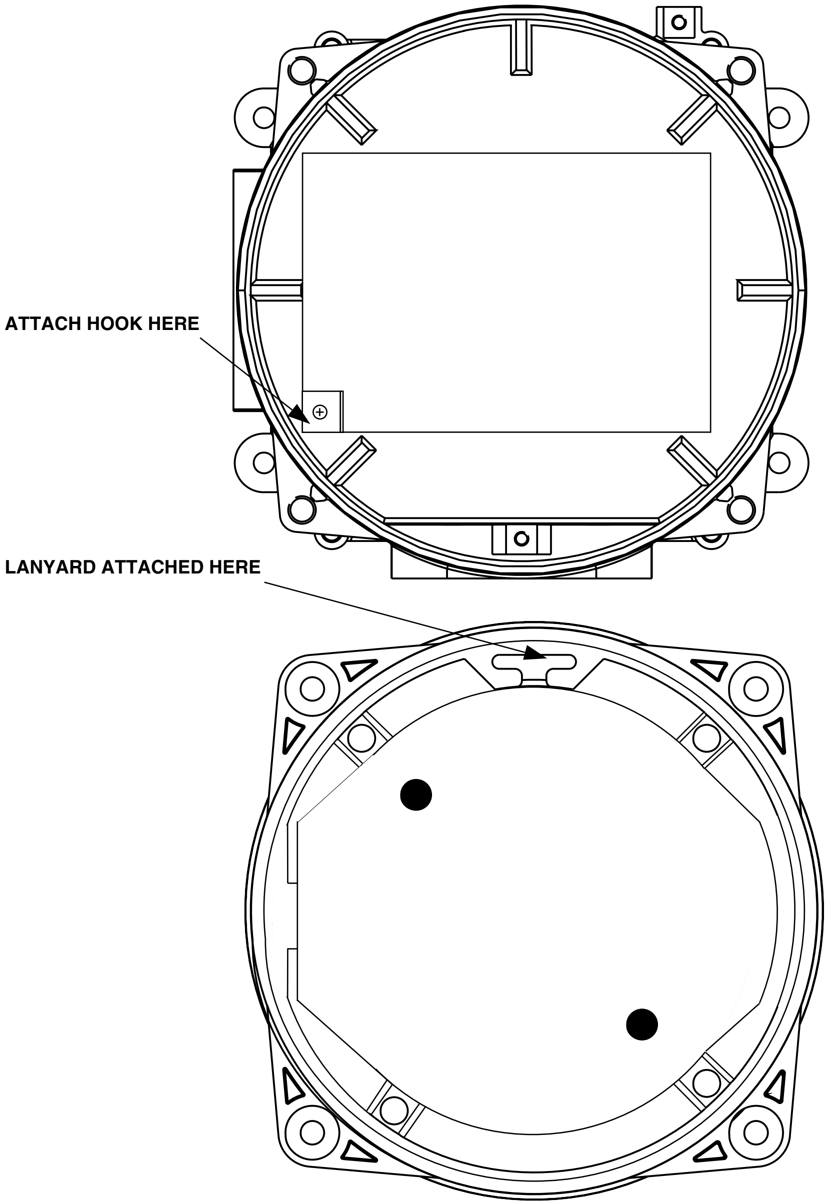


Fig. E-2 Hanging Cord Connection

1.2 ASSEMBLING THE UNIT

Connect the hanging cord (as a precaution) to the top and bottom assemblies as shown in Figure E-2). Connect the two preformed cables from the top assembly to the bottom assembly (with the cables running to the centre of the detector). Fit the front assembly to the rear assembly. Care should be taken to ensure that the internal wiring is not trapped between the terminal blocks and the front assembly.

It should be noted that a rubber seal is provided between the front and rear sections of the housing and this seal must be clean and dry before assembly. It is also important to ensure that no moisture is trapped inside the housing. Torque the four socket cap retaining bolts to 7 lb.ft (10 N.m) maximum.

At this stage the angle of the detector should be adjusted to view the required area and the fixing nuts and bolts finally tightened. The cable from the circuit to the detector should then be routed, using cable ties or clips as necessary, to minimise the risk of physical damage.

1.3 TESTING

The detectors may be tested with a specially designed tester called the T210+. This is a unit that is offered up to the front of the detector and produces a calibrated signal to check the detector sensitivity. This may be set to 50m, 25m or 12m ranges.

The T210+ is not flameproof, but is Approved for use in hazardous areas. The rating is BASEEFA Approved EEx eib IIC T4 for use in Zone 1 and Zone 2 areas for group 2 gasses or lesser hazards rated T1 - T4 as defined in EN 50014 : 1992 - Electrical Apparatus for Potentially Explosive Atmospheres - General Requirements.

SECTION F - MAINTENANCE

1. GENERAL

The FV282f+ detector contains encapsulated electronic assemblies. There are no replaceable or adjustable components within the housing, which should not be opened once installed and commissioned.

Routine maintenance is therefore limited to cleaning and testing the detectors.

1.1 ROUTINE INSPECTION

At regular intervals of not more than 3 months, detectors should be visually inspected to confirm that no physical damage has occurred and that the alignment of the detectors has not been disturbed. The detector windows should be checked to confirm that they are not blocked and that no physical obstructions have been placed between the detector and the protected area. Check that switch settings are correct.

In addition, at intervals of not more than 1 year, each detector should be checked for correct operation. Any excessive deposits of dirt, oil etc. should be removed from the detector housing as described in 1.2.

Note: The inspection frequency specified above should be considered as a minimum requirement to be applied in the average environment. The inspection frequency should be increased for dirtier environments or those which present a higher risk of physical damage.

For flameproof detectors, the following periodic checks should be made:

a) spigot joints should be separated and the faces examined for possible defects resulting from corrosion, erosion or other causes,

b) check that all stopping plugs and bolts are in position and tight,

c) no attempt should be made to replace or repair windows except by complete assembly replacement.

1.2 DETECTOR CLEANING

The FV282f+ detector is relatively tolerant of accumulations of dirt on the sensor window or optical monitoring reflector (see Fig F-1). However, thick deposits of dirt and oil will cause a loss of sensitivity and a subsequent fault indication.

It is recommended that detectors be cleaned using water or a detergent solution. A stiff bristle (not wire) brush may be used to remove heavy deposits. Particular attention should be paid to the reflector and sapphire window (Figure F-1).

Note: The act of cleaning or polishing the detector face and window may cause a detector to produce an alarm, it is important, therefore that before the window is cleaned, the detector should be disarmed by isolating the relevant circuit at the control unit. The circuit must be de-isolated as soon as cleaning is complete.

1.3 FAULT FINDING

If a fault is indicated at the controller it may be due to a number of self-test outputs, the most common fault would be obscuration of the window.

If the remote self-test is connected, put the controller into the walk test mode, by switching the self test input to 0V. If an alarm is indicated then the window is clean and the front-end circuitry is operating correctly.

Reset the controller and wait two minutes. If no fault is indicated then it is likely that the fault was due to a software watchdog timeout which might be caused in rare circumstances by very excessive electrical interference.

If the detector fails the remote test or no remote test can be performed, clean the window and the reflector as specified, reset the controller. If the detector still shows a fault after a $7^1/_2$ period, replace the detector.

It should be remembered that unless the processor has malfunctioned the detector will still be capable of detecting a fire at higher levels or with greater susceptibility to false alarms unless the window is totally obscured by something other than gradual contamination.

A faulty detector will be indicated by a flashing built-in yellow LED.

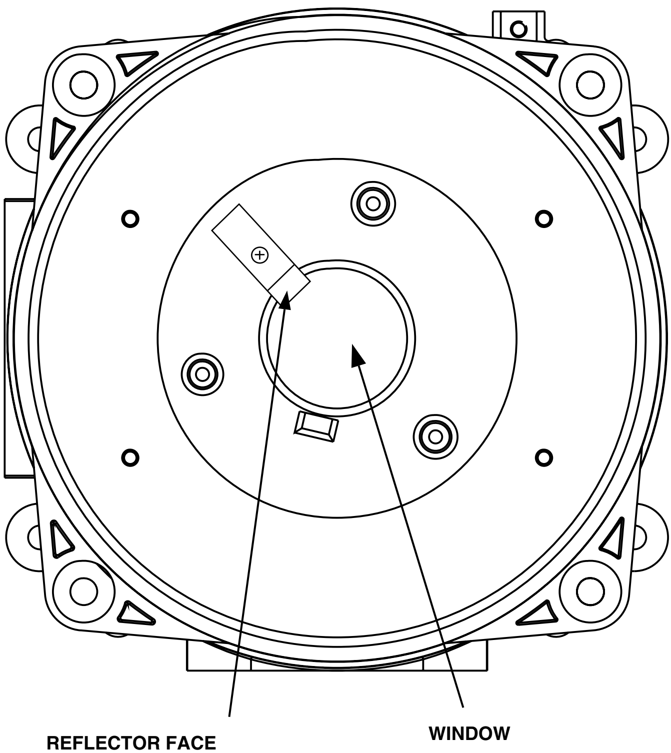


Fig. F-1 Reflector and Window

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